

**REMARKS**

Claims 10, 14, 18, 22, 26, and 27 are pending in this application. By this Amendment, claims 10, 26, and 27 are amended. Support for the amendments to the claims may be found, for example, in the claims as originally filed. No new matter is added.

In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

**I. Rejection Under 35 U.S.C. §112, Second Paragraph**

The Office Action rejects claims 10, 14, 18, 22, 26, and 27 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Claims 10, 26, and 27 are variously amended, as set forth *supra*, to obviate most of the issues presented in the Office Action. As to the issues that are not obviated by the claim amendments, Applicant respectfully traverses the rejection for the reasons presented below.

The Office Action asserts that claim 10 is indefinite because the claim recites V/G ( $\text{mm}^2/\text{K} \cdot \text{min}$ ) ranges that are contradictory. Claim 10 recites a method for producing a single crystal, wherein:

The single crystal is pulled while controlling a value of V/G ( $\text{mm}^2/\text{K} \cdot \text{min}$ ) within a range of values of V/G ( $\text{mm}^2/\text{K} \cdot \text{min}$ ); and ... the range of values of V/G ( $\text{mm}^2/\text{K} \cdot \text{min}$ ) is selected from the group consisting of: from  $-0.000724 [\text{mm}^2/(\text{°C} \cdot \text{K} \cdot \text{min})] \times T_{\text{max}} (\text{°C}) + 1.31 (\text{mm}^2/\text{K} \cdot \text{min})$  to less than  $-0.000724 [\text{mm}^2/(\text{°C} \cdot \text{K} \cdot \text{min})] \times T_{\text{max}} (\text{°C}) + 1.38 (\text{mm}^2/\text{K} \cdot \text{min})$ ;  $-0.000724 [\text{mm}^2/(\text{°C} \cdot \text{K} \cdot \text{min})] \times T_{\text{max}} (\text{°C}) + 1.38 (\text{mm}^2/\text{K} \cdot \text{min})$  or more; and from  $-0.000724 [\text{mm}^2/(\text{°C} \cdot \text{K} \cdot \text{min})] \times T_{\text{max}} (\text{°C}) + 1.31 (\text{mm}^2/\text{K} \cdot \text{min})$  to  $-0.000724 [\text{mm}^2/(\text{°C} \cdot \text{K} \cdot \text{min})] \times T_{\text{max}} (\text{°C}) + 1.35 (\text{mm}^2/\text{K} \cdot \text{min})$ .

In other words, in the method of claim 10, the value of V/G may be in any one of the above-listed three ranges. The ranges are selected individually, not at the same time and, thus, the

ranges are not inconsistent and do not contradict one another. Accordingly, reconsideration and allowance are respectfully requested.

**II. Rejection Under 35 U.S.C. §102(b)**

The Office Action rejects claims 26 and 27 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent Application Publication No. 2001/0025597 to Falster et al. ("Falster"). Applicant respectfully traverses the rejection.

Without conceding the propriety of the rejection, claims 26 and 27 are amended to more clearly recite various, novel features. However, even without the current amendments, the preambles of claims 26 and 27 recite, "The method of producing a single crystal according to Claim 10." This language clearly defines claims 26 and 27 as dependent method claims. The claims further limit the "single crystal" of method claim 10 and are not product-by-process claims.

Falster does not teach, nor is it asserted to teach, each and every element of claim 10. Claim 10 is not anticipated by Falster. Claims 26 and 27 depend from claim 10 and, thus, are also not anticipated by Falster. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**III. Rejection Under 35 U.S.C. §103(a)**

The Office Action rejects claims 10, 14, 18, and 22 under 35 U.S.C. §103(a) over U.S. Patent No. 6,048,395 to Iida et al. ("Iida") in view of U.S. Patent Application Publication No. 2001/0001944 to Kitamura et al. ("Kitamura"). Applicant respectfully traverses the rejection.

The combination of Iida and Kitamura would not have rendered obvious the method of claim 10 at least because of the deficiencies of Iida with respect to claim 10 and because of Kitamura's failure to cure Iida's deficiencies.

**A. The Deficiencies of Iida**

The Office Action acknowledges that Iida fails to teach (1) "determining a highest temperature (Tmax) between the crucible and the raw material melt" and (2) "providing a heat insulating material between the crucible and a heater." *See* Office Action at page 5. In addition to these deficiencies, Iida fails to teach at least the following distinctive features of claim 10.

Iida discloses a method for producing single crystals; however, it does not describe at all that "the range of values of V/G (mm<sup>2</sup>/K • min)...is controlled according to Tmax (°C);" and that Tmax (°C) is "a highest temperature of the raw material melt at an interface between a crucible inner wall and a raw material melt."

The Office Action asserts that Applicant's argument that Iida fails to teach or suggest that the single crystal is pulled while controlling the value of (V/G) (*see* July 17 Amendment at page 9) is inadequate. However, the Office Action's response to Applicant's clear assertion is unreasonable. The Office Action asserts that "by substituting a range of temperatures between 1400°C to 1414°C as a (T) in the equations  $-0.000724 \times T + 1.31$  (mm<sup>2</sup>/K•min) and  $-0.000724 \times T + 1.38$  (mm<sup>2</sup>/K•min), a value of between 0.119 and 0.121 (mm<sup>2</sup>/°C•min) will be obtained." *See* Office Action at page 4, line 23 - page 5, line 6. This conclusion is incorrect.

The lowest V/G value that can be calculated with any one of the three recited ranges if Tmax is substituted with a temperature between 1400°C to 1414°C, as suggested by the Office Action, would be 0.286. The equations that express the range of values of V/G yield the following rule: as the value of Tmax increases, the value of V/G decreases. Therefore, by taking the highest temperature asserted by the Office Action (1414°C), the lowest V/G value is calculated (0.286). 0.286 is significantly higher than the F/G value range of 0.119 and

0.121 as disclosed in Iida. Therefore, the range of V/G values, as recited in claim 10, would not have been rendered obvious by Iida.

Furthermore, the temperature range of 1400°C to 1414°C could not be the temperature range of T<sub>max</sub> because, according to the disclosure, T<sub>max</sub> has to be higher than the melting point of silicon. The Office Action asserts that Iida "teaches the melted silicon raw material is provided within a crucible, and further, a single crystal is pulled with a temperature within 1560°C to 1400°C," and that, therefore, Iida "clearly teach[es] a highest temperature of the melt inside the crucible." See Office Action at page 12, lines 1-15. However, Iida actually describes that "an average intra-crystal temperature gradient along the pulling direction within a temperature range of the melting point of silicon (1420°C) to 1400°C is represented by G (°C/mm)." See Iida at page 8, lines 7-8. This is completely different from the T<sub>max</sub> of the present application because T<sub>max</sub> is "the highest temperature of the raw material melt at an interface between a quartz crucible inner wall and the raw material melt." Therefore, T<sub>max</sub> cannot be lower than the temperature of silicon melt when silicon single crystals are grown by means of the present invention. Iida discloses that the melting point of silicon is 1420°C. Thus T<sub>max</sub> cannot be less than 1420°C for Iida. Thus, Iida's range of 1414°C to 1420°C does not disclose a range of T<sub>max</sub> values.

Moreover, Iida does not teach or suggest at least the above described features and the effects of the present invention. See July 17 Amendment at page 6, line 1 - page 7, line 7. Thus, it is impossible to derive the present invention from what Iida discloses.

#### **B. Kitamura's Failure to Cure Iida's Deficiencies**

Kitamura fails to cure at least Iida's above-stated deficiencies. Kitamura describes that "by employing a double crucible structure, the change in the temperature of the melt in the inner crucible can be made small, whereby defects such as growth striations observed in the obtained single crystal can be decreased." See Kitamura at paragraph [0041]. This

teaching would not have provided a reason to combine Kitamura with Iida because it has nothing to do with the method of claim 10, wherein  $T_{max}$  ( $^{\circ}\text{C}$ ) is the "highest temperature of the raw material melt at an interface between a quartz crucible inner wall and the raw material melt." Moreover, Kitamura as a whole does not teach or suggest the method of claim 10.

Accordingly, it is impossible to generate the  $T_{max}$  of claim 10 from Kitamura and, therefore, it is similarly impossible to derive the recited range of values of  $V/G$  ( $\text{mm}^2/\text{K}\cdot\text{min}$ ) in any of the following recited ranges:

- (1) "from  $-0.000724 \times T_{max} + 1.31$  to less than  $-0.000724 \times T_{max} + 1.38$ ;"
- (2) " $-0.000724 \times T_{max} + 1.38$  or more;" or
- (3) "from  $-0.000724 \times T_{max} + 1.31$  to  $-0.000724 \times T_{max} + 1.35$ ."

In addition to Kitamura's failure to teach or suggest the deficiencies of Iida, the Office Action fails to provide a reason to combine Kitamura's deficient teachings with Iida. In response to the Remarks presented in Applicant's July 17, 2008 Amendment, wherein the Applicant asserted that the combination of Iida and Kitamura is unreasonable, the Office Action asserts that combining Iida in view of Kitamura is proper because Iida and Kitamura both teach similar process steps for producing single crystals and that "Applicant's argument [against this assertion] is not persuasive because Applicant's attention is drawn to the point that Iida ... has not been used alone." *See* Office Action at page 10, line 9 - page 12, line 19.

The combination of Iida and Kitamura is improper. Kitamura discloses an apparatus for producing an oxide single crystal by means of a double crucible by a method to produce a single crystal by employing a structure that in the usual crucible, another crucible or cylinder having an opening for melt flow and having a small inner diameter, is arranged. *See* Kitamura at the Abstract and paragraph [0027]. The Kitamura and the Czochralski methods both have a process wherein a seed crystal is contacted with a melt filled in a crucible and pulled upward. However, this minor similarity is insufficient to justify the combination because the problems solved by the Kitamura and Czochralski methods are completely

different. Overall, the Kitamura and Czochralski methods are not similar or common, and the Office Action's use of Kitamura to allegedly cure the deficiencies of Iida is nothing more than hindsight reasoning.

The teachings of Iida and Kitamura, either separately or combined, fail to teach or suggest the method of claim 10. Moreover, the combination of the applied references is unreasonable in light of their separate and unrelated teachings.

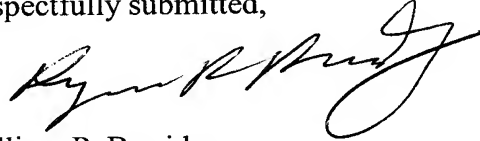
Claim 10 would not have been rendered obvious by the combination of Iida and Kitamura. Claims 14, 18, and 22 depend from claim 10 and, thus, also would not have been rendered obvious by Iida and Kitamura. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

**IV. Conclusion**

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place the application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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